TIME OF FLIGHT

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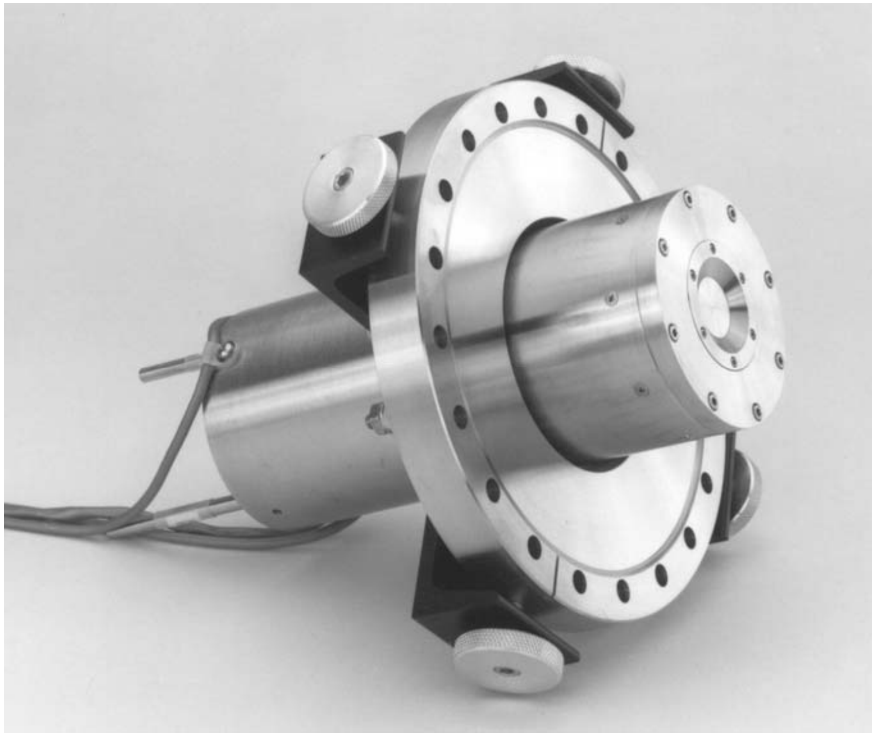
INSTRUCTION MANUAL

PSV PULSED SUPERSONIC VALVE
PSV P.S. PC BOARD REV 4A

WARNING

THIS EQUIPMENT USES VOLTAGES WHICH ARE DANGEROUS TO LIFE. IT SHOULD BE SERVICED ONLY BY QUALIFIED PERSONNEL USING PROPER SAFETY PRECAUTIONS.



C-211 PSV Pulsed Supersonic Valve
Shown here with Three Axis Mount and 8 Inch System Flange

PSV Power Supply

TABLE OF CONTENTS

1.0 SPECIFICATIONS

1.1 MECHANICAL SPECIFICATIONS

Nominal Gas Pulse Duration (FWHM)

Helium Carrier Gas	60 microseconds

Note: This figure is a very conservative one and user may elect to operate at 20-30 microseconds pulse width if choke flow is not required.

Maximum Repetition Rate	10 Hz
Maximum Backpressure	10 Atmospheres (132 P.S.I.G.)
Standard Nozzle Diameter	0.5 mm
Maximum Valve Body Temperature	
Valve Operating	70°C at 4000 Amps.
Bakeout (Valve not operating)	150°C

Warning:

The fan must be running during bakeout or severe damage will occur.

Note: The valve can be operated with choke flow to 100°C, but above 70°C the current must be increased due to increased resistance of the top spring. Above 100°C the transformer output voltage is too low to open the valve far enough for choke (nozzle conductance limited) flow. Also, as operating temperature and current are increased above these values, operating life of the top spring is shortened.

1.2 ELECTRICAL SPECIFICATIONS

Trigger Input	Positive Pulse 2.5 to 12 Volts Pulse Width 1 to 100 microsec.
Trigger Monitor Output	2.25 Volt positive pulse 20 microsec. pulse width
Trigger Delay	300 microsec. to 4.5ms continuously variable

1.3 SERVICE REQUIREMENTS

Input Power	100/120/220/240 Volts 1 Phase, 60 cycle
Heater Power	120 Volts, 0.5 Amp Max.

Cabinet Size	19.0" W x 14.0" D x 5.25" H
Cabinet Weight	18 Lbs.

2.0 GENERAL DESCRIPTION

The PSV Pulsed Supersonic Valve is a fully engineered, reliable product which offers unique advantages to the researcher who desires to do pulsed molecular beam work. The PSV comes in an easy-to-mount mechanical package and includes all necessary timing and driving electronics in a convenient and compact rack-mountable enclosure.

3.0 DISCUSSION

Molecular beam sources have been of increasing interest and importance to chemists and physicists over the last few years. In particular, the use of supersonic molecular beams has greatly increased with the realization that a supersonic expansion results in dramatic cooling of the translational, rotational, and vibrational temperatures of molecules entrapped in the expanding gas jet. As a result, molecular spectra of molecules under observation are simplified significantly. High resolution spectroscopic measurements can be made at sufficiently low density such that molecular interactions are unimportant and at sufficiently low temperature such that the sample is in a small number of well-defined rovibrational states.

Pulsed lasers have been most useful in spectroscopic studies of supersonic beams. In particular, their narrow line width, high peak power, and wide tunability make them nearly ideal sources for this work. Any experiment utilizing pulsed lasers is low duty cycle by its very nature. It thus makes most sense to utilize a pulsed supersonic beam. Detailed consideration of experimental parameters demonstrates that use of pulsed supersonic beams can, in fact, improve signal to noise and enhance thermodynamic cooling while simultaneously reducing system size and cost.

4.0 PRINCIPLES OF VALVE OPERATION

The PSV Pulsed Supersonic Molecular Beam Valve operates on the magnetic beam repulsion principle, first applied to molecular beam valves by Dimov[1]. The PSV design passes a current pulse of up to 5000 Amps and 20 microseconds pulse duration thru two parallel beam conductors in a hairpin configuration. The high current passing in opposite directions in adjacent conductors generates a magnetic force which lifts the top beam from the O-ring seal over the nozzle and opens the valve. This admits carrier gas to a supersonic free expansion nozzle which injects molecular beam pulses of approx. 60 microseconds pulse length into the sample vacuum chamber.

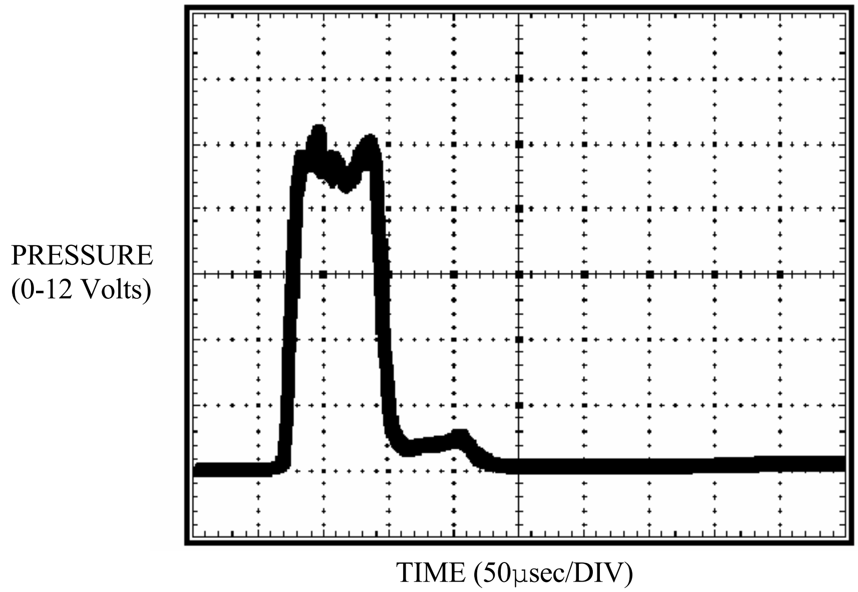


Figure 1: Fast Ionization Gage Pressure-Time Curve
Sample Pressure: 1.0 Atm. He, Nozzle Diameter: 0.5mm
Valve Current: 5,000 Amps (well above choke flow)
Gage Distance From Nozzle: 5.0cm

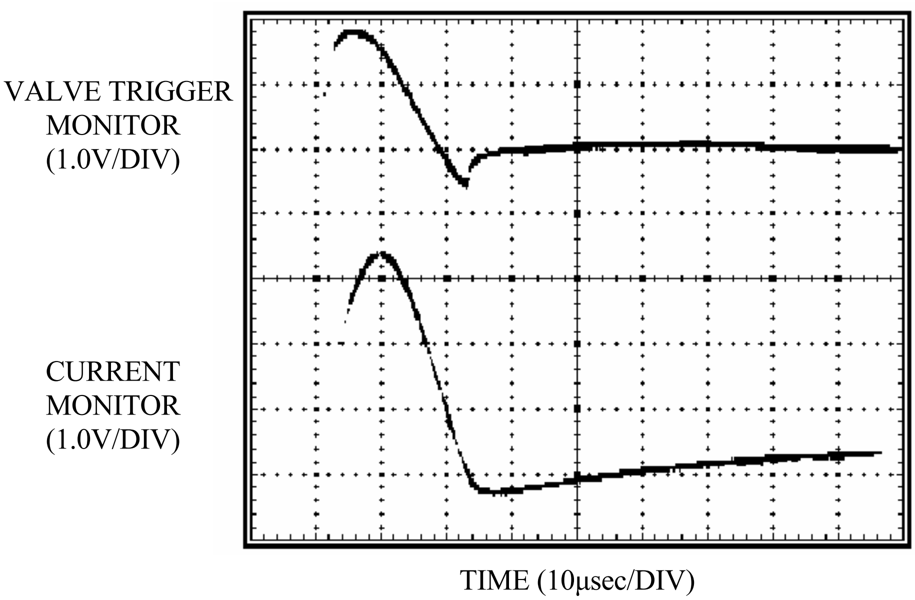


Figure 2: Valve Trigger Monitor Voltage and Current
Monitor Voltage at 4000 Amps and 1100 Volts

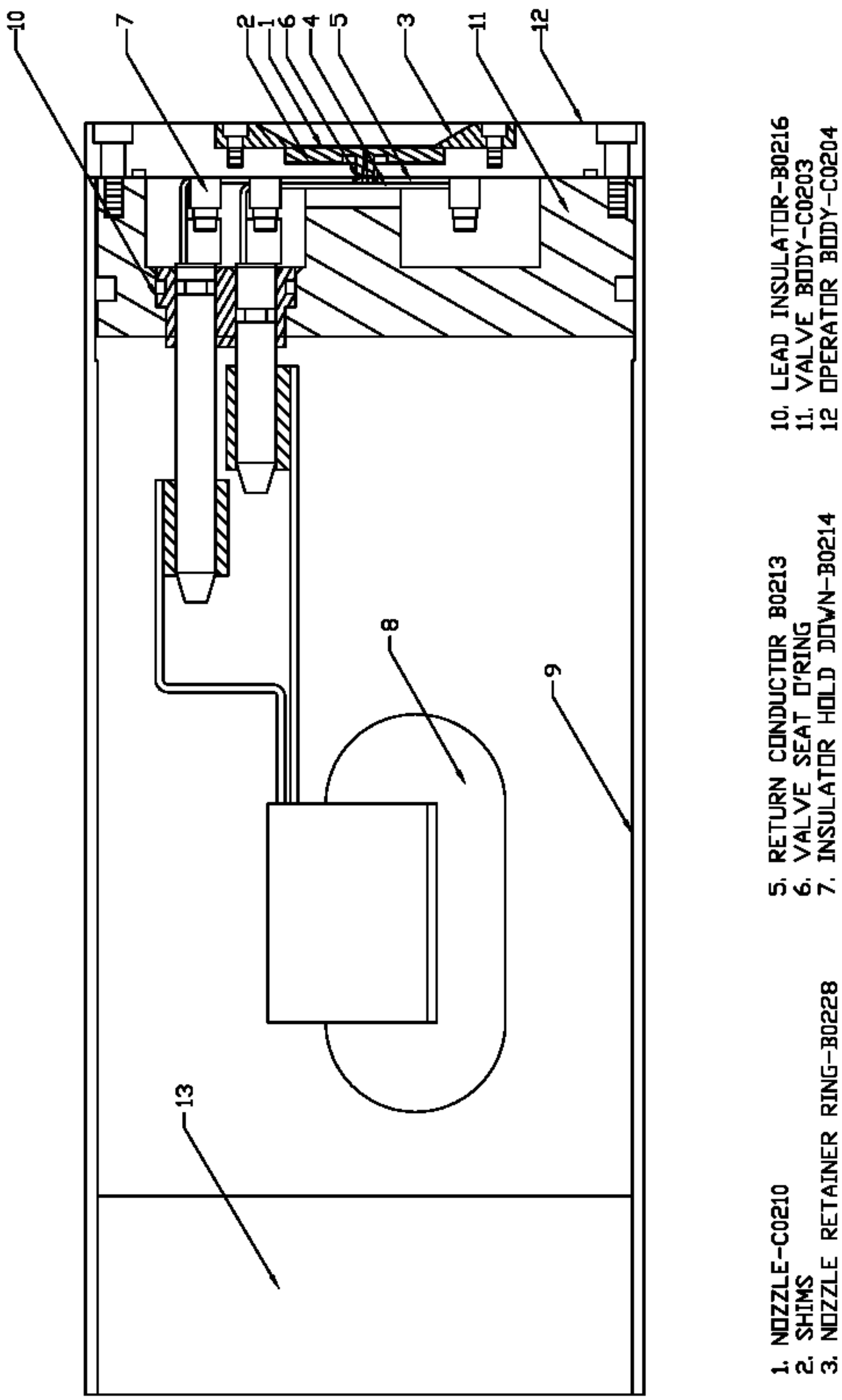


Figure 3: PSV Mechanical Assembly

Figure 1 shows an oscilloscope trace of a typical PSV pressure time curve taken with a fast ionization gauge as described by Gentry[2].

1. Dimov, G.I. Quick Acting Valves for admitting Short Gas Pulses into Vacuum Devices, Pribory I Tekhnika Eksperimenta, No. 5 pp. 168-171 September-October 1968, Nuclear Physics Institute, Academy of Sciences of the USSR.

2. Gentry, W.R. and Geise, C.F. Rev Sci. Instr., 49(5), 595(1978)

5.0 DESCRIPTION OF VALVE OPERATION

See Figure 3. A high current pulse is passed from the Transformer thru the Spring, causing it to snap upward away from the Return Conductor.

The carrier gas enters the inlet tube, passes into the Valve Body, across the valve spring and out the return tube. During the time when the spring is lifted, a small amount of gas passes under the spring, thru the Seat O-Ring and is expanded into the vacuum chamber thru the Nozzle.

Shims are used to establish optimum seat loading. The proper number is installed at the factory and this should vary only slightly, if at all, until the operator is disassembled.

The valve assembly is enclosed in and mounted to the vacuum system by the Housing Tube. The Fan prevents heat build up during operation and protects the electrical system during bakeout.

5.1 REMOVABLE OPERATOR MODULE

The PSV valve operator (operating mechanism assembly) is designed as a removable module for cleaning, service or replacement. Spare operators can be stocked for use on contamination critical experiments or as service spares.

5.2 REMOVABLE NOZZLE

PSV nozzles can be removed for cleaning, shimming adjustment, or replacement.

5.3 VALVE BODY HEATER

A 150 Watt, 120 Volt cartridge heater is incorporated into the valve body. This is useful with low vapor pressure samples where sample heating, and therefore valve body and nozzle heating is desirable. Rated maximum valve body temperature (valve operating) is 70°C.

5.4 VALVE BODY THERMOCOUPLE

Type J thermocouple (iron constantan) is buried in the valve body to permit monitoring and/or control of valve body temperature.

5.5 OPTIONAL PSV ACCESSORIES

5.5.1 SAMPLE CHAMBER

Specially designed flow-thru sample chamber allows introduction of liquid or solid into a carrier gas at pressures up to 10 atm.

5.5.2 THREE AXIS MOUNT

Allows movement of nozzle up to .125 inches in the X and Y, and 6 inches axial.

5.5.3 TEMPERATURE CONTROLLERS

Give hands-off control of body and sample chamber temperatures. A thermal interlock to the control unit provides over-temperature protection.

6.0 CONTROL UNIT CIRCUITRY DESCRIPTION

6.1 CONTROL UNIT

The control unit includes a regulated high voltage supply, an energy storage capacitor (charged by the supply), discharge circuitry to transfer energy from the capacitor to the transformer in the valve assembly, timing circuits, metering circuits, and protective circuits.

6.2 CIRCUIT DESCRIPTION

See Control Unit Schematic, Drawing No. D0103.

6.2.1 POWER SUPPLY

Line power (100/120/220/240 Volts, 50 or 60 Hz) is brought in thru a fuse, line switch, interlock switches, and a voltage selector switch to the main power transformer, T301.

The power indicator light, meter lights, and +/-15 Volt power supply are powered from one of the 120 Volt primaries of T301.

The 1200 Volt secondary of T301 is used to charge C201 the energy storage capacitor thru the high voltage regulator.

6.2.2 HIGH VOLTAGE REGULATOR

Capacitor C201 is charged through CR301, R201, Q9 and Q10. A1, Q5, Q6, Q7, Q8 and Q12 form a shunt regulator which drains excess charge from C201. Q11 is a trigger diode which fires Q9 and Q10 at the beginning of each half cycle of the line during the charging interval. When Q5-Q8 conduct, current is diverted from Q11 thru CR6, and SCR's Q9 and Q10 no longer fire. This reduces line current and energy consumption.

Diodes CR1, CR2 and CR3 charge C5 which supplies current thru R28 to maintain C201 at the desired voltage. R30, R32, R53 and R54 form a voltage divider which supplies feedback to the regulator A1. The feedback voltage is compared with the output of R104, the front panel "CURRENT ADJ." control. When Q12 is turned on it diverts current from going to Q5 and Q6 which starts to turn them off.

As Q5 and Q6 turn off, the voltage on C201 is increased thru R28. This will continue until the voltage on C201 becomes the voltage that is set by R104. R63 is used to set the maximum voltage available.

6.2.3 TIMING CIRCUITS

Q16 is a unijunction oscillator which provides 10 Hz pulses or variable 2 to 10 Hz pulses selected by the front panel switch S101. This allows the testing of the PSV system without external triggering. The system is normally synchronized by a signal from the Quanta-Ray DCR YAG laser "OSC" output. This signal is applied to A5, a precision delay timer with "COARSE" and "FINE" front panel controls. The output of A5 triggers Q15 a unijunction transistor which supplies trigger current to SCR Q4. The anode current of Q4 triggers Q3 which triggers Q2 which triggers Q1. These SCR's discharge C201 thru the output cable and the transformer in the valve assembly.

6.2.4 PROTECTIVE CIRCUITS

Timer A3-1 serves to limit the pulse rate of the system by removing voltage from the output transistor of A5(pin 12) for a preset period after each pulse.

A2 is used as a latching comparator which prevents further firing of the discharge circuits if any current pulse exceeds the preset "CURRENT LIMIT ADJ.". A2-1 compares the set "CURRENT LIMIT ADJ." voltage to a signal that is proportional to valve current from the current sense torroid. When the valve current exceeds the set limit the output of A2-1 drops to zero volts which causes the outputs of A2-2, A2-3 and A2-4 to drop to zero volts. This lights the front panel LED CR102 which shows the "OVER CURRENT" condition and also turns off Q15 which stops the power supply from pulsing the valve. The latch must be "RESET" with the front panel button S103.

The 120 Volts that powers the pulse valve fan is connected to a thermal switch that opens when the pulse valve body is above 150°C. The 120 Volts that is run thru the thermal switch is returned to power supply thru J203 PIN 3 to the coil of RL1. When the valve body overheats, the thermal switch opens, which turns off RL1 which turns on the "OVER TEMP" LED CR101 and also turns on Q17 which locks up the timer A5. This stops the power supply from pulsing the valve. This circuit automatically resets when the valve body temperature drops below 135°C.

A cover interlock switch, S201, is used to turn off the power when the top cover is removed. This switch has an "override" feature actuated by pulling the plunger. This permits energized testing of the equipment.

A thermoswitch, S202, turns off power if the unit overheats. This switch automatically resets on cooling.

6.2.5 METERING CIRCUITS

A4-1 and A4-2 are used in a peak reading metering circuit which will indicate either peak valve current or peak voltage on C201. Diodes CR11 and CR12 charge C22 to a voltage proportional to the positive peak of the selected signal. Charge leaks off of C22 thru R60 continuously and more rapidly thru R59 and Q13 after each trigger pulse. A3-2 times the discharge function.

7.0 DESCRIPTION OF CONTROLS

7.1 CURRENT ADJUST KNOB

Adjusts peak valve drive current amplitude over the range from about 2200 to 5000 Amps.

7.2 PEAK CURRENT/VOLTAGE METER

Reads either peak valve current or peak valve voltage depending on position of meter mode selection switch.

7.3 TRIGGER SWITCH

Selects the valve triggering mode for 10 Hz, 2-10 Hz variable, or external.

7.4 VALVE DELAY

Provides a continuously adjustable delay from the time of the "TRIGGER INPUT" signal to the triggering of the valve over a range from 300 microseconds to 4.5 milliseconds. "COARSE" adjustment is made with a small screwdriver, and a "FINE" adjustment with a range of 200 microseconds is made with the knob.

7.5 CURRENT LIMIT

Limits the maximum valve drive current to 5200 Amps. At this level the current limit relay will drop out and the "OVER CURRENT LED" will go on. The power supply can be turned on again by reducing the "CURRENT ADJ." setting and pushing the "RESET" button.

7.6 TEMPERATURE LIMIT

Limits the maximum valve temperature to 150°C. At this temperature the "OVER TEMP." light will come on and the valve will stop pulsing. When the temperature has dropped to 135°C the valve will automatically begin operating.

7.7 PULSE RATE LIMIT

Limits the pulse-rate of the valve to 12 Hz. At an external trigger pulse rate above 12 Hz the valve will drop to half pulse-rate.

7.8 TRIGGER INPUT

Input for external valve triggering. A positive 2.5 to 12 volt pulse of 1 to 100 microseconds width is required for external valve triggering.

7.9 CURRENT MONITOR

Provides a voltage signal proportional to the instantaneous drive current meter calibration on an oscilloscope. The peak current calibration is 4.20 Volts at 5000 Amps, i.e. current = 1190 x "CURRENT MONITOR" voltage.

7.10 VALVE TRIGGER MONITOR

Gives a positive 2.25 Volt pulse of 20 microseconds width at the time the valve is triggered.

8.0 INSTALLATION PROCEDURE

1. Check that "LINE VOLTAGE" switch on rear of Control Unit is set for correct line voltage.
2. Install Line Cord.
3. Connect Power Cable between Control Unit and Valve.
4. Valve may be bench tested for electrical functioning before installing on vacuum system.
5. Pump down vacuum chamber and check for vacuum leaks.
6. Heater leads are provided at cable end. There are also leads connected to the body temp. type J thermocouple (iron constantan) which may be used to monitor valve temperature.

   CAUTION: Leave power supply connected to the valve and turned on so that the fan is running whenever the valve is above ambient temperature. Failure to leave the fan operating during bakeout can damage the fan, transformer and other parts of the valve assembly.

WARNING:

1. DO NOT OPERATE OR BAKE VALVE WITHOUT COOLING FAN RUNNING.
2. DO NOT OPERATE VALVE ABOVE THE RATED 5000 AMPS AT ANY TIME.
3. DO NOT OPERATE VALVE ABOVE 4500 AMPS AT BACKPRESSURES BELOW 3.0 ATMOSPHERES (29 P.S.I.G.).
4. KEEP DRIVE CURRENT AS LOW AS POSSIBLE, CONSISTENT WITH GOOD RESULTS.

9.0 OPERATING PROCEDURES

Adjust nozzle position in X, Y and Z planes before pumpdown when using optional three axis mount. Be sure clamp is tight before applying vacuum.

9.1 SET UP

1. Pump down the vacuum chamber.
2. Set "CURRENT ADJ." control to minimum (rotate full counter-clockwise).
3. Set meter mode switch to "CURRENT" position (left).
4. Switch "TRIGGER" mode switch to "OFF".
5. Switch on "POWER".
6. Switch "TRIGGER" mode switch to the internal 10 Hz oscillator or an external trigger input as desired.
7. Adjust the "CURRENT ADJ." control for "choked flow", i.e. increase current until detector signal amplitude reaches a maximum. This current level will be about 4000 Amps at 1.0 atmosphere backpressure (0 PSIG), and about 4400 Amps at 5.0 atmospheres (59 PSIG), and about 5000 Amps at 10 atmospheres (132 PSIG). Refer to 9.2.
8. If so desired, the molecular beam pulse can be synchronized with another event by using the valve delay.

9.2 TECHNIQUE

After installing according to Section 8.0 and initiating operation according to 9.1, the valve will be clicking and vacuum system pressure will show an increase. This indicates that the valve is functioning properly.

9.2.1 **ALIGNMENT**

The molecular beam must now be aligned with the skimmer, detector, etc. This may be done optically by shining a laser backward thru the skimmer and moving the nozzle into the center of the projected beam. It may also be done by moving the nozzle while observing the sensitivity of the detected beam.

9.2.2 **SYNCHRONIZATION**

The laser must now be synchronized so that the primary event of excitation occurs during the time of maximum beam intensity and therefore highest sample density. This is usually a simple matter of adjusting the delay while observing detector sensitivity.

9.2.3 **SENSITIVITY PROBLEMS**

Figure 4 is an approximation showing the Beam Pressure Profile using a normal working drive current and one using the maximum drive current available. This is to illustrate the difference between real and perceived beam intensity.

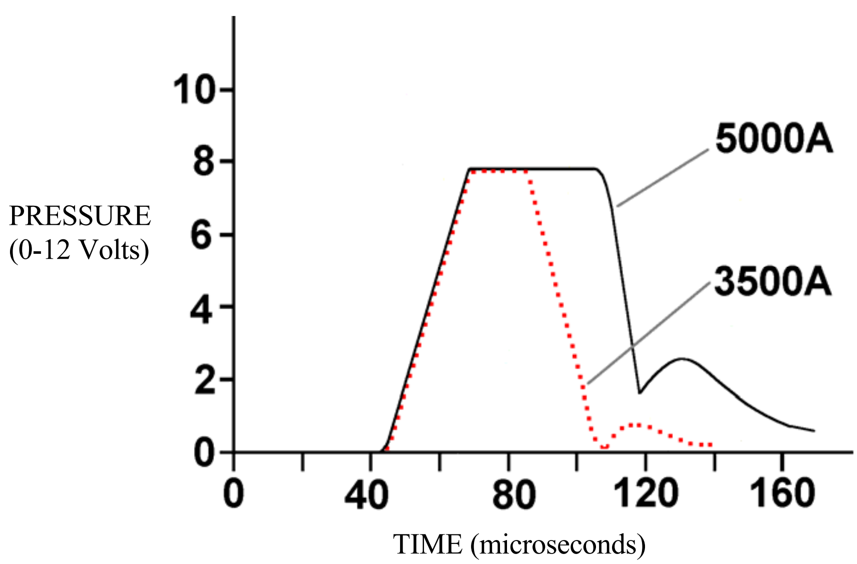


Figure 4: PSV Beam Pressure Profile From Fast Ion Gage

If the detector sensitivity is being measured at time B, and valve drive current is 3500 Amp, relative sensitivity will be 2 Volts. If the drive current is then increased to 5000 Amp, relative sensitivity will increase to almost 8 Volts. This may be perceived as a fourfold increase in intensity due to the increased drive current. The system pressure will seem to verify this by showing a significant increase. This is misleading.

If we make the same observations at point A, we can see that this increase in current yields no corresponding increase in relative sensitivity. It can be seen that operating at this point gives a much longer dwell time even at the reduced drive current and is therefore the most stable.

We may therefore conclude that operation above the minimum current required for choked flow:

1. Greatly increases pumping requirements.
2. Increases the local pressure in the experiment and therefore the probability of arc down, contamination and deterioration of electron multiplier gain.
3. Contributes nothing to the sensitivity of a properly aligned and synchronized experiment.
4. Shortens the life of the valve spring.

Low sensitivity is almost always due to something other than insufficient drive current. Some typical problems are:

1. Sample condensing out of the carrier gas.
2. Toluene condensate swelling the viton valve seat O-ring so the valve would not open. (In this case, Kalrez or TFE coated O-rings were the solution.)
3. Beam not aligned.
4. Pulse not synchronized.
5. Prolonged operation at high current can cause the spring to work harden. This will increase the minimum current required to achieve choked flow. The spring must be replaced.

It is very difficult to tell whether or not you have choked flow unless you can monitor the beam profile with a fast ion gauge. Increasing valve current should be the last choice of things to try to increase sensitivity.

10.0 VALVE MAINTENANCE PROCEDURES

10.1 VALVE OPERATOR REMOVAL

The valve operator can be removed for cleaning or replacement as follows:

1. Remove the eight #6-32 socket head cap screws from the face of the valve.
2. Pull off the operator assembly from the valve body, making certain that it is not allowed to tilt during removal. It is necessary to overcome the 9 to 11 pound mating force of the bayonet connectors when pulling it off, so expect some resistance. Avoid the temptation to pry it loose. Use of fingers only is safest.

10.2 VALVE CLEANING

The operator assembly and the sample chamber in the valve body can be cleaned with methanol. Sample deposits can be loosened by soaking the operator assembly in methanol and brushing with a Q-tip or acid brush.

The materials which are in contact with the sample in the valve are as follows:

Gold plating

304 stainless steel

Teflon

Viton O-rings (fluorocarbon elastomer)

10.3 ACCESS FOR MAINTENANCE

1. Turn off power supply and disconnect cable.
2. Remove any valves or fittings which may be attached to inlet and return tubes.
3. Remove cable clamps at outer end of valve.
4. Remove 8 flat head screws from around the housing tube.
5. Invert the valve on a flat surface and push down on the housing tube. The inlet and return tubes will press against the valve body and push it out of the housing. This operation will go slowly because of the sliding resistance of the O-ring.
6. Examine the surface of the O-ring for any evidence of having been nicked by sharp edges of the screw holes. If so, replace the O-ring and deburr the inside rim of the holes with a countersink.

Note: This and lead thru O-rings are sliding seals and must be lubricated with vacuum grease or they will roll and scuff during assembly.

10.4 CLOGGED NOZZLE CLEANING

In cases where a low vapor pressure sample and inadequate valve body heat are being used, the nozzle may become clogged. Symptoms are disappearance of detector signal, and no change in chamber pressure from the valve off to the valve on condition. It may be possible to open a clogged nozzle as follows:

1. Increase backpressure to 10 atmospheres.
2. Increase drive current to 5000 Amp.
3. Heat valve body to the maximum rated temperature.

If the above steps do not open the nozzle, it will be necessary to remove the nozzle and clean it.

Clogged nozzles can be cleaned by soaking in Methanol, probing with a small wire, and blowing out with clean compressed air. Do this with care to avoid mechanical damage to the nozzle.

10.5 NOZZLE REMOVAL

The nozzle can be removed as follows:

1. Remove the six #2-56 socket head cap screws and the nozzle retaining ring.
2. Rock the nozzle to loosen the O-ring static seal and allow the nozzle to drop out into the hand. Be careful not to lose the small nozzle seat O-ring.

10.6 NOZZLE SHIMMING

Provision is made in the design for adjusting the spacing between nozzle and valve spring with aluminum shims. Too great a distance will not give enough O-ring pressure and will not seal in the static (valve off) position. If this is the case, remove the shims one at a time (.001 inch increments) until reliable static sealing is achieved.

10.7 INSPECTION OR REPLACEMENT OF THE NOZZLE O-RING

If it is impossible to achieve a static vacuum seal by shimming, the nozzle O-ring seal should be removed for inspection. If the O-ring sticks to the valve spring, it can be gently loosened with a small jeweller's screwdriver. The O-ring should be inspected for damage with a microscope. If damaged, it should be replaced with one which has been selected by microscope inspection.

11.0 CONTROL UNIT SERVICE PROCEDURES

11.1 SAFETY PRECAUTIONS

This equipment uses voltages up to 1800 Volts DC and capacitors which store dangerous amounts of energy. The control unit should be unplugged from the power line before opening.

Although bleeder resistors are provided, all high voltage capacitors should be discharged by shorting their terminals before touching any electrical components. The high voltage capacitors are C5 and C201. C5 is mounted on the P.C. Board near the heat sinks. C201 is on the rear panel.

If energized testing of internal circuits is required, connections to test points should be made with the equipment OFF. The cover interlock can then be overridden by pulling the plunger.

Dangerous voltages exist on the power transformer, rectifier, high voltage capacitors, and those parts of the circuit board not surrounded by the ground plane on the top surface.

11.2 NORMAL OPERATION

Meter readings and waveforms should be observed and recorded during normal operation to aid in diagnosis of any problems. Figure 2 shows typical trigger monitor and current monitor waveforms at 4000 Amps peak current.

The ratio of peak voltage to peak current is determined by valve impedance. Any significant change in this ratio would indicate a problem in the valve assembly. This ratio will increase slightly with temperature.

The waveform at the current monitor jack should be a half sinusoid with a short high frequency transient at the beginning and an exponential tail at the end, as shown in Figure 2.

11.3 TROUBLESHOOTING

11.3.1 No power or Meter Light

Check power source and fuse. If okay, feel upper rear panel. If hot, thermal interlock may have tripped. It will reset after cooling. This could be caused by shorted SCR's Q1, Q2, Q3, Q4, Q9 or Q10.

11.3.2 High Voltage Not Controlled By Front Panel Knob

Transistors Q5, Q6 or Q12 can be shorted. A1 may be bad.

11.3.3 No pulses, High Voltage Controllable

Press "CURRENT LIMIT RESET". If pulses start, reduce the current. If the "CURRENT LIMIT" LED is on and cannot be reset A2 is bad and very possibly CR13 and Q15 are bad.
Observe the "OVER TEMP." LED. If the "OVER TEMP." LED is on check J203 AND F202 on the rear panel. Check J4 and RL1 on the PC Board.
Check "VALVE TRIGGER MONITOR" with oscilloscope. If no signal, trace signal thru timing circuits.

11.3.4 SUBSTITUTION TESTING

All integrated circuits in this equipment are mounted in sockets and can easily be changed. Do not reverse position of IC's or they will be destroyed. IC's have a notch on the end near pin #1 and/or a dot over pin 1. The number 1 is marked on the PC board to show this location.

11.3.5 **ELECTROMAGNETIC INTERFERENCE AND PICKUP**

When the external trigger signal comes directly from a laser, significant noise from the laser ground can be introduced into the PSV control unit ground and then on to other equipment (e.g. high voltage PMT supplies, etc.). Should this be a problem, we suggest use of a small isolation transformer, such as the PE-2231X from Pulse Engineering, San Diego, CA, to isolate the noisy laser ground from the PSV control unit.

12.0 VALVE TEMPERATURE CONTROL

12.1 ACCESS TO ELECTRICAL CONNECTIONS

1. Remove housing tube (see 10.3).
2. Remove fan shroud from over barrier strip J-1. (See valve Wiring Schematic C206.)

12.2 WIRING

A 115 Volt variac or a household light dimmer can be connected to the cartridge heater across terminals 8 and 9.

A thermocouple read out meter can be connected to the type J thermocouple at terminals 10 and 11.

12.3 AUTOMATIC HEATER CONTROL

Schematic C205 shows the valve connected to a proportioning temperature controller. This allows hands-off control of temperature with over temperature protection.

Should valve temperature exceed 150°C, the PSV Power Supply will shut down and the temperature controller will also shut down until the "OVER TEMP." LED goes out.

13.0 SPARE PARTS LIST

Stainless Fasteners:

6 each #2-56 x 5/16" socket cap
6 each #2-56 x 3/16" socket cap
8 each #6-32 x 3/8" socket cap
4 each #6-32 x 1/4" phillips pan
4 each #6-32 x 3/8" kep nut
8 each #4-40 x 1/4" phillips flat head

Viton O-Rings:

1 each #001 - valve seat
3 each #007 – conn. plug and nozzle face
1 each #018 - lead insulator
1 each #039 - operator face
1 each #235 - housing circumference

Miscellaneous:

1 each screwdriver, #0 Phillips
1 each screwdriver, #1 Phillips #1
1 each 5/64" hex key
1 each 7/64" hex key
4 Shims - .001" Stainless Steel
2 Sets - Teflon Ferrules
1 Pair - Swagelok Nuts

14.0 NOTES ON INSTALLATION OF THREE AXIS MOUNT

The flange which mounts the TAM to the vacuum system should be bored thru 3 3/4" I.D. and four holes should be drilled and tapped on the face of the flange 1/4-28 X 1/4 deep on a 5" diameter bolt circle. This flange is usually a 6" O.D. CONFLAT or larger. If it is 6" as shown on drawing CO224, the bolt holes in the flange must be counterbored for socket head bolts, since the sliding plate would not mate with the face of the flange due to the bolt heads.

With the TAM assembled as shown on drawing CO224, it may be seen that X & Y movement are allowed by the oversize fit between the stud in the system flange and the 1/2" holes in the sliding plate. This movement is approximately 1/8" in any direction and should be sufficient to align with the skimmer of most experiments.
The clamping plate is all that prevents the valve from being drawn into the vacuum chamber by atmospheric pressure. For this reason, it must be adjusted with the vacuum chamber at atmosphere and clamped firmly on the tube before pumping down the chamber.

All the parts and their functional relationship can best be seen in section AA of CO224. To change lateral position of the nozzle:

1. Loosen the four nuts which clamp the sliding plate to the system flange.
2. Move it to the new position using the knurled jack screws.

To change insertion depth:

1. Let the chamber to atmospheric pressure.
2. Remove the four nuts which hold the clamping plate.
3. Use the 5/32" hex key to loosen the clamping screw several turns.
4. Push a screwdriver blade into the slot to hold the clamp open while it is moved to the new position.
5. Remove the screwdriver and make sure the clamp is square with the tube.
6. Tighten the clamp and replace the hold down nuts.

Warning:

Do not attempt to adjust the insertion depth while under vacuum. Severe damage will occur.
